

**Short Communication**

## Sensory education program development, application and its therapeutic effect in children

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### Abstract

There has recently been increased interest in the emotional intelligence (EQ) of elementary school students, which is recognized as a more important value than IQ (intelligence quotient) for predict of their success in school or later life. However, there are few sensory education programs, available to improve the EQ of elementary school student's in Korea. This study was conducted to develop an educational program that reflects the characteristics and contents of traditional rice culture and verify the effects of those programs on the EQ of children. The program was developed based on the ADDIE (Analysis, Design, Development, Implementation and Evaluation) model and participants were elementary school students in 3<sup>rd</sup> and 4<sup>th</sup> grade (n = 120) in Cheonan, Korea. Descriptive statistics and paired t-tests were used. EQ scores pertaining to the basic sense group, culture group, and food group were significantly improved after the sensory educational program ( $P < 0.05$ ), but no change was observed in the control group. These findings indicate that sensory education contributed to improving elementary school children's Emotional Intelligence (EI) and their actual understanding about Korean traditional rice culture.

**Key Words:** Sensory education program, children, emotional intelligence, rice kit

### Introduction

National dietary guidelines and dietary behavior education are needed due to the increase in socioeconomic costs, including medical costs, owing to the worldwide increase in chronic disease. Eating habits acquired in childhood are fixed and this will eventually influence lifelong health. Children's eating habits and dietary behaviors are influenced by social, environmental and educational factors, which lead to formation of foods values [1]. Thus, a sensory education program including tasting of various foods and sorting of food types is critical to the formation of correct eating habits for children. Sensory education, targeting elementary school students accustomed to the flavor of fast foods who do not know the names and tastes of traditional foods has been conducted in France Since 1990. The goal of sensory education is to allow elementary school students to eat and understand the succession of traditional foods [2]. Sensory education programs include activities pertaining to the five senses, tasting and cooking experiences of traditional foods, and learning local specialties [3,4]. Preferences for foods and flavors are based on experience, and food choice is a learned behavior from personal experience and the environment. However, sense of taste is very difficult to change once developed. Thus, it is essential to perform sensory education from the perspective of prevention. Sensory education is an integrated approach, that is

most effective when provided with programs designed to increase social and emotional development, and plays an important factor in the formation of ideal mental development for children who are in the process of developing personality [5]. There has recently been growing interest in children's EQ (Emotional Intelligence), which is recognized as a more important value than IQ (Intelligence Quotient) for prediction of success in school or life. In addition, EQ enhances academic skills and peer relationship in school settings, and has the potential for use as an index to determine the practical values [6].

Rice is a staple food in Korea that has low-fat and higher fiber and can prevent chronic disease. Rice culture contains the sentiment of the nation and is thus the nucleus of traditional culture, which will help children understand the foundations of Korean culture. Accordingly, it is critical to inherit and develop rice culture as cultural asset. Online games are recognized as adverse social issues, and there has been increasing interest in entertaining and educational effects through games. 'G-Learning (Game-based Learning)' has been a pioneer in spreading the pure function of the game [8]. Game functions include increased concentration, focus and persistence and they can be an effective method of instilling a positive mindset and a lasting image. Sensory education while playing games is expected to dilute the hazards of games while inducing the concentration and interest of children, which will eventually increase the educational effect.

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The game market has evolved from simple play function into a various functional game market [9]. A bridge between games and education is needed to reverse the function of games from negative to positive. Therefore, in this study, we attempted to improve familiarity with rice culture by maximizing a sensory education program through a virtual system. Few previous studies of sensory education programs have been conducted, and those that have focused on cookery taste education [10] and the development of sensory educational materials [11]. Recently, Park (2013) investigated the influence of sensory education on children's personalities and reported that a sensory education program can help elementary school students' cognitive function, and emotional, social, and activity development [12]. However, the study of sensory education program have been started, and rice-oriented Korean-style sensory educational program has not been developed.

Therefore, in this study we attempted to contribute to the overall understanding of children's physical development and EQ by developing various rice-culture characteristics. In particular, we expected to provide essential information to children while facilitating the development of 3-D, flash animation, and cyber technology by the game industry.

## Methods

### Participants

Elementary school students in 3<sup>rd</sup> and 4<sup>th</sup> grade in CheonAn, Choong-nam Province, Korea were recruited using a simple random sampling method. The study participants consisted of 126 students who agreed to participate. Overall, there were 71 boys (56.3%) and 55 girls (43.7%) (Table 1).

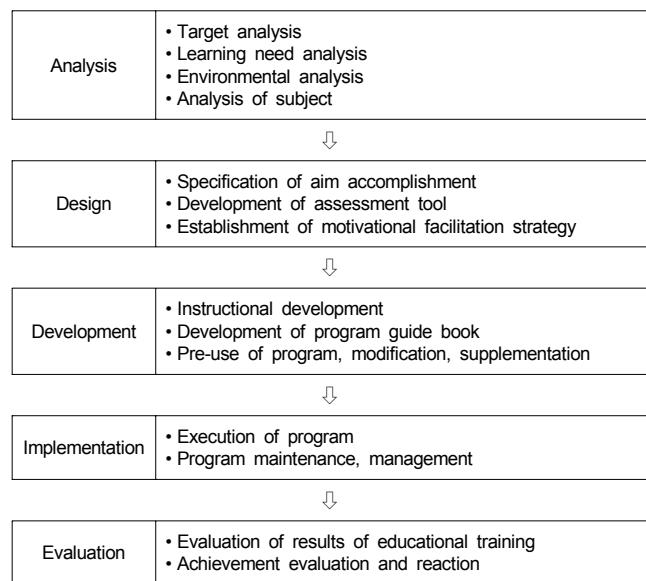
### Development of Program Model

In this study, The ADDIE (Analysis, Design, Development, Implementation, Evaluation) model developed by System Development (ISD: Instructional System Development) was used to generate an effective and efficient sensory educational program [ED highlight- please check whether this is correct, also, is System Development a company? If so, specify, if not, clarify what this is by breaking the sentence apart.] [13]. The basic steps involved in application of ADDIE are as follows:

In the analysis stage, traditional rice culture data, the cognitive process of basic senses, the threshold level of basic senses, and

**Table 1.** General Characteristics of Subjects

| Grade           | Male |      | Female |      | Total |       |
|-----------------|------|------|--------|------|-------|-------|
|                 | N    | %    | N      | %    | N     | %     |
| 3 <sup>rd</sup> | 27   | 21.4 | 22     | 17.5 | 49    | 38.9  |
| 4 <sup>th</sup> | 44   | 34.9 | 33     | 26.2 | 77    | 61.1  |
| Total           | 71   | 56.3 | 55     | 43.7 | 126   | 100.0 |



**Fig. 1.** Development of Educational Tool Using the ADDIE Model

emotional intelligence tool data were collected through a literature study and analyzed. Design of the assessment tool was based on the pretest-posttest control group design method. The survey tool developed by Moon (1996) was used to measure the degree of emotional intelligence for elementary school students [14]. This survey tool consists of five questions pertaining to emotional cognition, five questions evaluating emotional expression, five questions for emotional empathy, and seven questions targeting emotional control. The survey tool's reliability was high as indicated by a Cronbach  $\alpha$  score of 0.835. The responses for positive questions were based on a 5 point Likert scale with 5 indicating 'Strongly Agree' and 1 indicating 'not at all', while those for negative questions ranged from 1 point for 'Strongly Agree' to 5 points for 'not at all'.

In the development stage, sensory education programs and program guide books were developed. The programs were composed of tutorials, basic sensory education, rice culture experience, rice dishes cooking experience, etc., and guide books for each stage were developed. G-learning program development was performed through trend survey analysis, character drawing, 3D modeling, character UV mapping, programming, graphics and sound operations and included in the game program. A series of processes and all scoring records associated with each sensory test can be checked in the program.

Program implementation was performed in elementary school A in Cheonan, Korea targeting 3<sup>rd</sup> and 4<sup>th</sup> graders ( $n = 120$ ). Class modification was processed 7 times over six months in 2013.

During the evaluation process, responses for sensory education training were evaluated. EQ pre-tests were performed by homeroom teachers in designated schools and post tests were conducted after all programs were carried out. Test questions consisted of a total of 22 questions and took about 10 minutes for the child to complete. After surveys were filled out they were

collected and analyzed.

#### *Application of the educational programs to teaching in the class*

To determine whether taste education improves children's EQ, a rice-oriented traditional Korean sensory education program was conducted seven times. Each program was processed every 80 minutes using audio-visual devices to describe the themes, theoretical education through group games, basic sensory education through I-Pads, rice kits, rice cultural experimental education, and rice cooking experiments. Generally, the groups consisted of about 30 students, with one teacher responsible for all of the program processes assigned to five students. Teachers responsible for the education were trained in advance and were graduate students majoring in Foods and Nutrition.

#### *Statistical analyses*

Statistical analyses were performed using SPSS 20.0 for Windows. To determine the demographic characteristics, frequency (N) and percentage (%) were calculated. A paired t-test was performed to compare the child's emotional intelligence score between the control and experimental groups while controlling for emotional intelligence pre-test score.

## **Results**

#### *Study design*

Contents and manuals were developed for nutritional education teachers and children for application in educational settings. Program development was based on the ADDIE system model.

Rice-oriented Korean sensory educational programs for elementary school students consist of five basic sensory education and traditional rice culture experiments designed to enhance children's EQ. Education programs were divided into four groups, a control group in which no education was received, basic sensory group (group I), basic sensory and rice culture experiments cultural experimental group (group II), basic sensory, rice cultural experiments, and rice cooking experiments (group III) (Table 2). A pre-test was performed before sensory education by using an emotional intelligence tool, and a post-test was

**Table 2.** Research design for analysis of the effect of sensory education on children's emotions

| Group      | Pre-inspection               | Program                      |                              |                              | Post-inspection              |
|------------|------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|
|            |                              | Session 3                    | Session 5                    | Session 7                    |                              |
| Control    | O <sub>1</sub> <sup>1)</sup> | Y <sup>3)</sup>              | Y                            | Y                            | O <sub>2</sub> <sup>2)</sup> |
| Experiment |                              |                              |                              |                              |                              |
| Group I    | O <sub>1</sub>               | X <sub>1</sub> <sup>4)</sup> | Y                            | Y                            | O <sub>2</sub>               |
| Group II   | O <sub>1</sub>               | X <sub>1</sub>               | X <sub>2</sub> <sup>5)</sup> | Y                            | O <sub>2</sub>               |
| Group III  | O <sub>1</sub>               | X <sub>1</sub>               | X <sub>2</sub>               | X <sub>3</sub> <sup>6)</sup> | O <sub>2</sub>               |

<sup>1)</sup> O<sub>1</sub>: (Pre-inspection) Child's Emotional Intelligence

<sup>2)</sup> O<sub>2</sub>: (Post-inspection) Child's Emotional Intelligence

<sup>3)</sup> Y: School class

<sup>4)</sup> X<sub>1</sub>: Program application (basis sensory education)

<sup>5)</sup> X<sub>2</sub>: Program application (rice culture education)

<sup>6)</sup> X<sub>3</sub>: Program application (rice food education)

performed after each group's education.

Educational contents were developed based on literature reviews and researcher meetings. Educational contents included three steps, basic sensory education (session 3), rice cultural experiments (sessions 4-5) and rice food experiments (sessions 6-7) (Table 3). For all steps, educational contents included friendly rapport activities and rice growing process, excellence [ED highlight- please clarify what you mean by this, e.g., how is this an educational content?], and traditional rice culture shown in tutorials. Basic sensory training included sight, smelling, hearing, touch, and tasting. Visual education consisted of the degree of transparency, image according to color, starch iodine reaction, BTB's acid-base experiments. Smelling test included three components, identifying the smells of natural ingredients, traditional sauces, and vegetable oils. Taste sensory training included matching four basic flavors, four basic flavor levels, sweet taste synergic effects, and sour taste synergic effects. Hearing senses include basic hearing, sorting food sounds, and rice culture sounds. Touching senses included three components, differentiating temperatures, food surface texture, and ingredient texture.

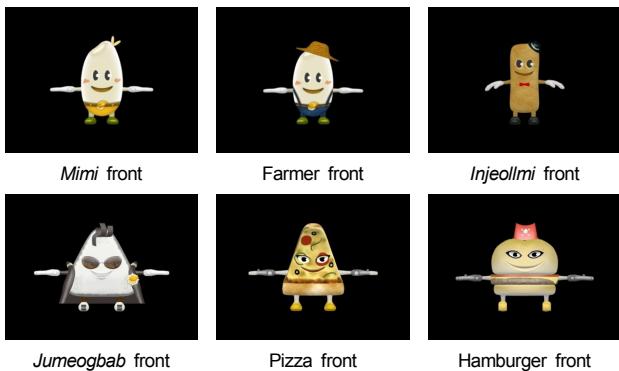
#### *Development of Educational Tools and Guidelines*

##### *Children's sensory educational programs' character development*

For effective sensory education of children, characters were developed to represent various foods (Fig. 2). Rice was characterized and named "mimi" and processed in the form as rice. "Injeollmi" and "Jumeogbab" characters were also developed

**Table 3.** Selected Topics and Contents For Sensory Education [ED highlight - please note, all words capitalized in this table heading and that of Table 1, only the first word is capitalized in that of Table 2. Please choose one form and use consistently throughout the paper. Also, please adjust table columns prior to submission as this table is difficult to read.]

|                      | Session 1   | Session 2                   | Session 3  | Session 4                        | Session 5  | Session 6   | Session 7                       |
|----------------------|---|-----------------------------|--|----------------------------------|--|---|---------------------------------|
| Topic                | Rapport forming                                   | Tutorial                    | Basics sense   | Narration therapy                | Music therapy                                      | Food therapy  | Food therapy                    |
| Objectives           | Friendliness forming                              | Program understanding       | Understanding the five senses                                  | Rice story experience            | Rice instrument and music experience               | Rice food cooking   | Rice food cooking               |
| Educational contents | Care activity (enjoying Korean traditional foods) | Rice grown Rice superiority | The five senses (sight, smell, touch, texture, hearing, taste) | 'The good siblings The King Yuri | Maracas making Ocean drum making Folk song singing | I-pad cooking Rice ball, Rice glue ball, Tteokbokki cooking | I-pad cooking Rice cake cooking |
| Educational material | Slide board                                       | I-pad                       | I-pad rice kit   | I-pad                            | I-pad stationery                                   | I-pad cookware  | I-pad cookware                  |



**Fig. 2.** Character Conception and 3D Modeling.



**Fig. 3.** Development of teaching aids.

as other traditional Korean foods. In contrast, “hamburger” and “pizza” characters were developed to maximize the problems associated with western style dietary behaviors and the benefits of rice. Also, a “Mr. Farmer” character that played the role of educator and served as the game’s guide was developed to increase familiarity with farmers.

#### *Development of Sensory Educational Tools*

When systematic sensory education is performed in practical settings, educational programs and tools are needed for effective training. In this study, a rice-kit was developed to assess the cognitive abilities of the five senses. All samples used in the kit were in the form of dry powder or oil extracts so that they could be stored for a long period of time. The rice kits included turbidity education using sodium caseinate, rice flour, salt, potato

flour and starch utilization-iodine reaction, as well as vinegar, acid-base reactions using baking powder, and matching the natural color of ingredients using rice, arrowfoot, grapes, squash, sugar, salt, and quinine sulfate. In addition, the rice kits enabled four different types of concentration flavor levels to be distinguished. Specifically, a small amount of salt added to sugar was tasted and compared to a small amount of organic acid mixed with salt. Hearing education included the sound of frying rice cake, boiling soup, and eating noodles, as well as sounds associated with rice culture such as winnowing, pounding, sounds made by a rice cooker and washing rice. Olfactory education consisted of smelling tangerines, apples, garlic, onion, sesame flavor, soy sauce, doenjang, gochujang, soybean oil, sesame oil, and perilla oil. Tactile education included distinguishing cool and hot using ice and hot packs and the texture of zucchini, ginger, cucumber, rice dough, jelly, radish, tofu, rice cake and rice soup. One of the G-learning tools, an I-pad training sensory educational program, was developed to provide effective education. The rice-oriented traditional Korean sensory education program was termed “rice mimi adventure” and consisted of 5 steps, rice research and development center, science center, cultural center, cooking experience center and surveys. The rice research and development center consisted of the birth of rice, sensory education, and foods made from rice. The science center was developed as a tool to assess visual, taste, smell, texture, and cognitive functions. The culture center consisted of the brothers and King Yuri story, constructing a musical instrument, and singing a song. Cooking experience included games involving preparation of joomeokbab, gyungdan, tteokbokgi, ssalgangjeong, and rice cakes by students to acquire cooking skills. Surveys were conducted to assess children’s EQ, and 22 items were included in the I-Pad as emoticons.

#### *Development of Guidelines*

Instructor’s guidelines were made under the assumption that the instructor had no experience with sensory education class. Materials consisted on an instructor’s manual, “Usage for Rice Kit and I-Pad,” as well as four books entitled, “Rice-oriented Traditional Korean Sensory Education Program” that included theoretical backgrounds and educational contents (Fig. 4).

#### *Implementation (Field Application)*

Because participants in this study were mainly elementary school students, we included diverse and interesting activities for subjects to participate in to make the program easy and fun. Education programs progressed in the order of rapport forming, tutorials, basic sensory education, rice culture experience and preparation of rice food. Taking photos during education is suggested (Fig. 5).



Fig. 4. Manuals for Korean Sensory Education Program Based on Rice.

### Evaluation of Emotional Cultivation Effects

*'Children's Emotional Intelligence' Cultivation Effects by Participation in Rice-oriented Traditional Korean Sensory Education Program*

After sensory program education was performed, the EQ score improved relative to the control group. The rice-oriented traditional Korean sensory education program had a significant effect on improving children's EQ scores ( $P < 0.001$ ) (Fig. 6). The EQ score for the basic sense group was 54.12 before the sensory education and then improved to 73.64 ( $P < 0.001$ ). In the culture group, the EQ score improved from 52.25 to 76.54 ( $P < 0.001$ ). In the food group, the score improved from 61.40 to 80.62 ( $P < 0.001$ ). Among three groups, the culture group (5 times) showed the greatest difference between the before and after sensory educational program. In contrast, the control group's EQ score was 53.64 before the sensory education program and 55.60 after the program, which did not differ significantly. These findings indicate that the developed rice-oriented Korean style sensory education program improves children's EQ score, and



Session 1 Rapport forming



Session 2 Tutorial



Session 3 Basics Sense



Session 4 Narration Therapy



Session 5 Music Therapy



Session 6 Food Therapy



Session 6 Food Therapy

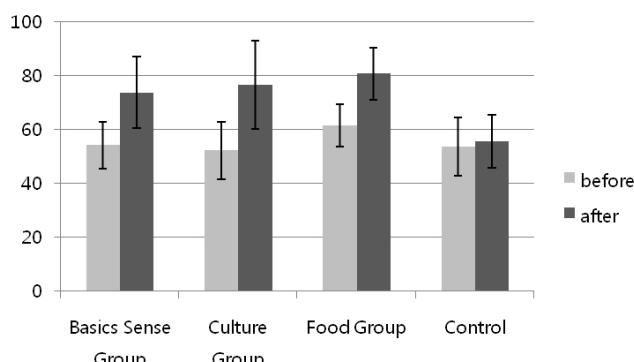


Session 7 Food Therapy



Session 7 Food Therapy

Fig. 5. Field Application of Korean Sensory Education Program Based on Rice.



**Fig. 6.** Descriptive Statistical Analysis of Emotional Intelligence with Program Application.

the sensory education program not only conveys knowledge, but can also have a synergic effect when combined with traditional Korean culture. An EQ score consists of four components including self-awareness, self-management, social awareness, and relationship management. In this study, the rice-oriented traditional Korean sensory education program significantly improved the overall EQ score ( $P < 0.001$ ). Overall, the results indicate that sensory education is very effective at improving children's EQ.

*Changes in "Self-Awareness Intelligence" in Emotional Intelligence based on Sensory Education Program Participation*

Among EQ components, self-awareness can be divided into one's self and other self. Self-awareness is the ability to recognize emotions in one's self and basic for EQ. The rice-oriented Korean style sensory education program revealed no significant difference between before and after sensory education. Children's self-awareness intelligence decreased from 6.28 to 5.96 in the basic sense group, and decreased from 5.63 to 5.58 in the culture group. In the food group, the self-awareness score increased from 5.83 to 6.62. In contrast, self-awareness score increased from 5.76 to 6.16 in the control group. Overall, these findings indicated that the sensory education program did not impact self-awareness EQ improvement.

**Table 4.** Change of Self-awareness Intelligence with Program Application.

| Group                           | Self-awareness            |             | t-value | P-value |
|---------------------------------|---------------------------|-------------|---------|---------|
|                                 | Before                    | After       |         |         |
| Basic Sense Group <sup>2)</sup> | 6.28 ± 1.65 <sup>1)</sup> | 5.96 ± 2.37 | 0.496   | 0.624   |
| Culture Group <sup>3)</sup>     | 5.63 ± 2.58               | 5.58 ± 2.43 | 0.045   | 0.964   |
| Food Group <sup>4)</sup>        | 5.83 ± 1.78               | 6.62 ± 1.90 | -2.023  | 0.048   |
| Control <sup>5)</sup>           | 5.76 ± 1.92               | 6.16 ± 1.91 | -0.784  | 0.440   |

<sup>1)</sup> Mean ± SD

<sup>2)</sup> Basic Sense Group: session 1-session 3

<sup>3)</sup> Culture Group: session 1-session 5

<sup>4)</sup> Food Group: session 1-session 7

<sup>5)</sup> Control: untreated group

#### *Changes in Others-Awareness Emotional Intelligence Based on Sensory Education Program Participation*

Emotional awareness for others is the ability to recognize their emotional responses and show empathy for others. In other words, it is the ability to read the feelings of others and feel others' emotions as their own, which is important because it is the basis of human social skills.

After implementing programs, the students' EQ to recognize others improved ( $P < 0.001$ ). Specifically, scores for the basic sense group improved from 6.76 to 11.12 ( $P < 0.001$ ). In the culture group, scores improved from 6.04 to 11.29 ( $P < 0.001$ ). In the control group, there was a decrease from 5.40 to 5.12 ( $P > 0.001$ ). Thus, the developed rice-oriented traditional Korean sensory education program helps improve children's EQ and social development by improving empathy.

#### *Changes in Emotional Expression Intelligence by Sensory Education Program Participation*

Changes in EQ score by sensory education program are shown in Table 7. Emotional expression surveys consisted of five items that could be expressed as 25 full points. After implementing the sensory education program, there was significant improvement in the food group ( $P < 0.001$ ), but no improvement in the other three groups. Thus, in the food group, the EQ score was 14.62 before the sensory education program and 17.27 after the sensory educational program, indicating that it was not easy to improve the children's emotional expression ability. Accordingly,

**Table 5.** Change of Others-Awareness Intelligence in Response to Program Application.

| Group                           | Others-awareness |              | t-value                 |
|---------------------------------|------------------|--------------|-------------------------|
|                                 | Before           | After        |                         |
| Basic Sense Group <sup>2)</sup> | 6.76 ± 1.76      | 11.12 ± 2.54 | -5.743*** <sup>6)</sup> |
| Culture Group <sup>3)</sup>     | 6.04 ± 2.46      | 11.29 ± 3.85 | -4.992***               |
| Food Group <sup>4)</sup>        | 7.31 ± 2.17      | 11.46 ± 2.46 | -8.684***               |
| Control <sup>5)</sup>           | 5.40 ± 2.29      | 5.12 ± 2.09  | 0.762                   |

<sup>1)</sup> Mean ± SD

<sup>2)</sup> Basic Sense Group: session 1-session 3

<sup>3)</sup> Culture Group: session 1-session 5

<sup>4)</sup> Food Group: session 1-session 7

<sup>5)</sup> Control: untreated group

<sup>6)</sup> \*\*\* $P < 0.001$  based on a paired t-test

**Table 6.** Changes in Emotional Expression Intelligence by Sensory Education Program Participation.

| Group                           | Emotional Expression |              | t-value                 |
|---------------------------------|----------------------|--------------|-------------------------|
|                                 | Before               | After        |                         |
| Basic Sense Group <sup>2)</sup> | 14.00 ± 2.61         | 15.84 ± 3.40 | -1.944                  |
| Culture Group <sup>3)</sup>     | 13.67 ± 2.68         | 15.17 ± 4.86 | -1.157                  |
| Food Group <sup>4)</sup>        | 14.62 ± 2.94         | 17.27 ± 3.83 | -3.661*** <sup>6)</sup> |
| Control <sup>5)</sup>           | 13.44 ± 3.37         | 13.92 ± 3.01 | -0.700                  |

<sup>1)</sup> Mean ± SD

<sup>2)</sup> Basic Sense Group: session 1-session 3

<sup>3)</sup> Culture Group: session 1-session 5

<sup>4)</sup> Food Group: session 1-session 7

<sup>5)</sup> Control: untreated group

<sup>6)</sup> \*\*\* $P < 0.001$  by paired t-test

**Table 7.** Changes in Empathetic Affection Intelligence in Response to Sensory Education Program Participation.

| Group                           | Empathetic affection |              | t-value                 |
|---------------------------------|----------------------|--------------|-------------------------|
|                                 | Before               | After        |                         |
| Basic Sense Group <sup>2)</sup> | 10.40 ± 2.93         | 17.44 ± 4.35 | -5.489*** <sup>6)</sup> |
| Culture Group <sup>3)</sup>     | 11.08 ± 4.10         | 19.00 ± 5.34 | -4.659***               |
| Food Group <sup>4)</sup>        | 13.33 ± 3.42         | 19.81 ± 3.50 | -8.106***               |
| Control <sup>5)</sup>           | 11.04 ± 3.76         | 12.24 ± 4.13 | -1.408                  |

<sup>1)</sup> Mean ± SD<sup>2)</sup> Basics Sense Group: session 1- session 3<sup>3)</sup> Culture Group: session 1-session 5<sup>4)</sup> Food Group: session 1-session 7<sup>5)</sup> Control: untreated group<sup>6)</sup> \*\*\*P<0.001 by paired t-test

additional sessions and various programs for sensory education programs may be needed to improve student's emotional expression ability.

#### *Changes in Empathetic Affection Intelligence Score in Response to Sensory Education Program Participation*

Empathetic affection is the ability to fully understand one's own feelings and encompass them as their own. There were five items in the empathetic affection survey with 25 full points. Following implementation of the sensory program, the score improved from 10.40 to 17.44 in the basic sense group ( $P < 0.001$ ), while in the culture group the score increased from 11.08 to 19.00 ( $P < 0.001$ ) and in the food group there was an improvement from 13.33 to 19.81 ( $P > 0.001$ ). In contrast, there was improvement from 11.04 to 12.24, with no significant difference in the control group. These findings indicate that the rice-oriented traditional Korean sensory education program effectively improves empathetic affection ability.

#### *Changes in Self-Regulation by Sensory Education Program Participation*

Self-regulation ability is the ability to treat and change one's own emotions. It is very important to regulate emotions appropriately for emotional well-being [15]. Thus, children's ability to regulate and control their emotions is very important for them to feel happiness. Questions regarding self-regulation ability consisted of 4 items, and 20 full points. After program

**Table 8.** Changes in Self-regulation Intelligence by Sensory Education Program Participation.

| Group                            | Self-regulation |              | t-value                 |
|----------------------------------|-----------------|--------------|-------------------------|
|                                  | Before          | After        |                         |
| Basics Sense Group <sup>2)</sup> | 9.56 ± 2.60     | 13.56 ± 2.84 | -4.305*** <sup>6)</sup> |
| Culture Group <sup>3)</sup>      | 9.21 ± 2.67     | 14.38 ± 4.33 | -3.936***               |
| Food Group <sup>4)</sup>         | 11.90 ± 2.55    | 15.23 ± 2.15 | -7.503***               |
| Control <sup>5)</sup>            | 10.60 ± 3.20    | 10.72 ± 3.20 | -0.167                  |

<sup>1)</sup> Mean ± SD<sup>2)</sup> Basics Sense Group: session 1-session 3<sup>3)</sup> Culture Group: session 1-session 5<sup>4)</sup> Food Group: session 1-session 7<sup>5)</sup> Control: untreated group<sup>6)</sup> \*\*\*P<0.001 by paired t-test**Table 9.** Changes in Others-Regulation Intelligence with Program Application.

| Group                            | Others-regulation |              | t-value                 |
|----------------------------------|-------------------|--------------|-------------------------|
|                                  | Before            | After        |                         |
| Basics Sense Group <sup>2)</sup> | 7.12 ± 1.86       | 9.72 ± 2.35  | -4.313*** <sup>6)</sup> |
| Culture Group <sup>3)</sup>      | 6.63 ± 2.72       | 11.13 ± 3.40 | -4.134***               |
| Food Group <sup>4)</sup>         | 8.42 ± 1.66       | 10.23 ± 2.48 | -4.146***               |
| Control <sup>5)</sup>            | 7.40 ± 1.68       | 7.44 ± 2.45  | -0.076                  |

<sup>1)</sup> Mean ± SD<sup>2)</sup> Basics Sense Group: session 1-session 3<sup>3)</sup> Culture Group: session 1-session 5<sup>4)</sup> Food Group: session 1-session 7<sup>5)</sup> Control: untreated group<sup>6)</sup> \*\*\*P<0.001 by paired t-test

implementation, the basic sense group's score improved from 9.56 to 13.56 ( $P < 0.001$ ), while in the culture group there was an increase from 9.21 to 14.38 ( $P < 0.001$ ) and in the food group there was a significant improvement from 11.90 to 15.23 ( $P < 0.001$ ). In contrast, there was a small increase from 10.60 to 10.72, which was not significant in the control group. Thus, the sensory education program was an effective tool to improve children's ability to control emotions.

#### *Changes in Regulating Others Intelligence by Sensory Education Program Participation*

Interpersonal relationship skills are the ability to effectively maintain personal relationships with others. The ability to control others is a social skill that provides positive aspects in relationships, improves persuasive and influential skills, and is useful to comfort others [16]. There were three items evaluating control of others with 15 full points.

After implementing sensory educational programs, the basic sense group's score improved from 7.12 to 9.72 2.6 ( $P < 0.001$ ). There was an improvement from 6.63 to 11.13 in the culture group, and an improvement from 8.42 to 10.23 in food group ( $P < 0.001$ ). In contrast, there was a small increase from 7.40 to 7.44 in the control group ( $P > 0.001$ ). Thus, the rice-oriented traditional Korean sensory education program is very effective at improving children's interpersonal skills.

## Discussion

This study contributed to development of children's physical and emotional intelligence by presenting various rice culture characteristics in sensory education programs. Various sensory experiences in childhood are important for development of a combination of eating habits and mental and physical development. This study was conducted to help children experience a variety of tastes in traditional food materials, form new values regarding foods and learn correct eating habits for physical development. Furthermore, the program developed in this study enhanced the self-esteem of children through traditional rice experience and the development of emotions through a wide range of group activities such as understanding, sharing and

caring. Based on traditional rice culture, we developed programs, materials, and guidance to generate a unique Korean children's sensory education program. To evaluate the effects of the sensory educational program, pre- and post-tests were designed. [ED highlight- consider moving this to the beginning of the paragraph.]

First, contents and manuals for easy and effective sensory educational programs were developed for nutrition education teachers and teachers in related dietary behavior fields. A study program, the ADDIE (Analysis, Design, Development, Implementation, Evaluation) systemic model was then developed. Rice characteristics were subsequently developed from characters depicting rice and traditional rice based products, while characters for hamburgers and pizza were developed to maximize the issues associated with westernized dietary behaviors. Moreover, a rice kit was developed to assess basic senses cognitive functions. Sensory education was then conducted seven times in 80 minute sessions. Classes were composed of theme description courses that employed audio-visual devices, theory education administered via group games, and basic senses education through an I-pad, rice kit device, and rice-cultural experiences education. EQ scores significantly improved in all experimental groups compared relative to the control group, indicating that the developed rice-oriented traditional Korean sensory education program led to a significant increase in EQ that was greater when combined with traditional Korean culture education.

In this study, sensory education programs targeting students were found to be effective at improving emotional education. By combining traditional rice cultural experiences and sensory education programs, student's self-awareness ability, controlling ability, recognition of other cultures, controlling ability and eating behaviors were improved. Development of rice-oriented traditional Korean sensory education characteristics and contents is expected to instill positive images and familiarities for rice cultures, increase rice consumption, and promote sensory education. Furthermore, appropriate eating behaviors can be established to prevent disease in the future.

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